THE EVIDENCE FOR SECRET UNDERWATER BASES

There is compelling circumstantial evidence that the US military has been constructing secret underwater and underground tunnels and bases for many decades.

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Stories of underground tunnelling by the United States Navy are very persistent. When I first started my research, people began telling me that the US Navy was involved in clandestine tunnelling and secret underground base construction. Over the years, I have encountered bits and pieces of information suggesting that there may well be undersea naval facilities.

A former associate of mine, who had been in the Navy, told me that there are tunnels on both coasts of the United States that submarines enter when they are at sea, and then travel through to secret, underground submarine bases that are inland from the coast. I have been told, time and again, about purported submarine tunnels in the Long Beach, California, area that allegedly bore inland from the ocean.

Soviet-style Submarine Tunnels

In fact, there is precedent in the open literature for such tunnels—albeit in Russia. In their excellent book, *Blind Man's Bluff: The Untold Story of American Submarine Espionage*, Sherry Sontag and Christopher Drew relate that in the 1980s:[1]

> The Soviets also were building four large underwater 'tunnels' at a new submarine base at Gremikha near the tip of the Kola Peninsula, about 150 miles from Murmansk. Blasted out of the adjacent hillside, the granite tunnels were large enough to accommodate the *Typhoons*...

Have similar underwater tunnels been built by the United States Navy to secretly accommodate its submarines, perhaps in the Long Beach, California, area and elsewhere? I consider it possible.

Tunnelling into the Continental Shelf

I have been given hints that there may be lengthy, secret tunnel systems beneath the continental shelf, off both coasts of the United States. I have spoken to a few insiders in recent years, and I plainly asked one of them: "What about the stories of highly secret naval installations beneath the ocean floor, to which submarines secretly come and go? And what about the stories of secret, undersea bases and hundreds of miles of secret tunnels deep beneath the sea floor along the Atlantic and Pacific coasts of the United States?"

The answer was intriguing: "I would carefully consider those stories."

And so I am paying attention to the stories. I will tell you candidly that I do not know whether the stories are true or not. They are interesting. If they are true, then there are sophisticated, clandestine undersea bases and tunnels that the United States government operates—and has kept secret from the American people.

Bases beneath the Oceans and Seas

It is important to understand that the technology exists for constructing manned, undersea bases hundreds, even thousands, of feet below the sea floor. The experience, the expertise, the machinery, the trained personnel and the financial means for constructing manned bases beneath the ocean floor have been in place for at least 35 years. Bear in mind that the petroleum industry routinely and frequently carries out major industrial operations in deep water, well out to sea. It also routinely bores down into the deep rock beneath the ocean floor.

A recent news item on CNN's website profiled one of the deep-sea divers involved in

recovering bodies of drowned sailors from the sunken Russian submarine, the *Kursk*. The diver works for the giant multinational industrial conglomerate, Halliburton Co. According to the article, the diver worked on unspecified undersea projects with a range of construction activities including "welding, concrete work—whatever jobs can be done undersea".[2]

Let me relate a personal anecdote. In 1976, while hitchhiking through Scotland, I caught a ride with an ex-diver for the British Navy. He was working at that time in the oil fields in the North Sea, and described his work routine to me as follows. He would put on a diving suit and travel down to the sea floor where he would carry out major construction work, which involved strenuous work on pipelines and valves and the assembly of structural components.

The simple point I am making is that the offshore petroleum industry has had the capability for decades to carry out heavy industrial activities on the sea floor. This capability could easily be extended to constructing airlocks and openings for undersea bases.

Where tunnelling is concerned, operating a tunnel boring machine (TBM) in solid rock, hundreds of feet below the ocean floor, really presents no greater a technical challenge than operating a TBM in solid rock hundreds of feet below the surface of solid ground. In both cases the machine and its operators are in an enclosed environment.

Indeed, one source mentioned to me that "'in principle" there is nothing to stop a TBM from tunnelling out beneath the sea bed from onshore. Once offshore, beneath the sea, there is nothing to stop the TBM from tunnelling along the coastline, miles out to sea, beneath the sea floor. And no one would be the wiser.

The state-of-the-art progress for a TBM in good rock is several miles per year.[3] With just one machine and one crew, a 100-mile tunnel system could certainly be secretly constructed in 10 to 20 years. If just five machines were employed, 500 miles (or more) of secret tunnels could be excavated in the same period of time. This is well within the state of the art of tunnel boring technology.

Indeed, at a recent meeting between the heads of state of Japan and South Korea, the then Japanese Prime Minister Yoshiro Mori proposed constructing a 108-mile-long undersea rail tunnel between Japan and South Korea. The purpose of the tunnel would be to facilitate trade and to provide a rail link between Japan and the Eurasian land mass. In the words of Prime Minister Mori: "The construction is technically possible, but the problem is money."[4]

The money to carry out a secret project of this sort certainly exists in the Pentagon's "black budget". The requisite infrastructure of secrecy to carry out such a project has been in place in the military-industrial complex for decades now. And there is even a paper trail that shows US Navy interest in building manned bases deep beneath the ocean floor.

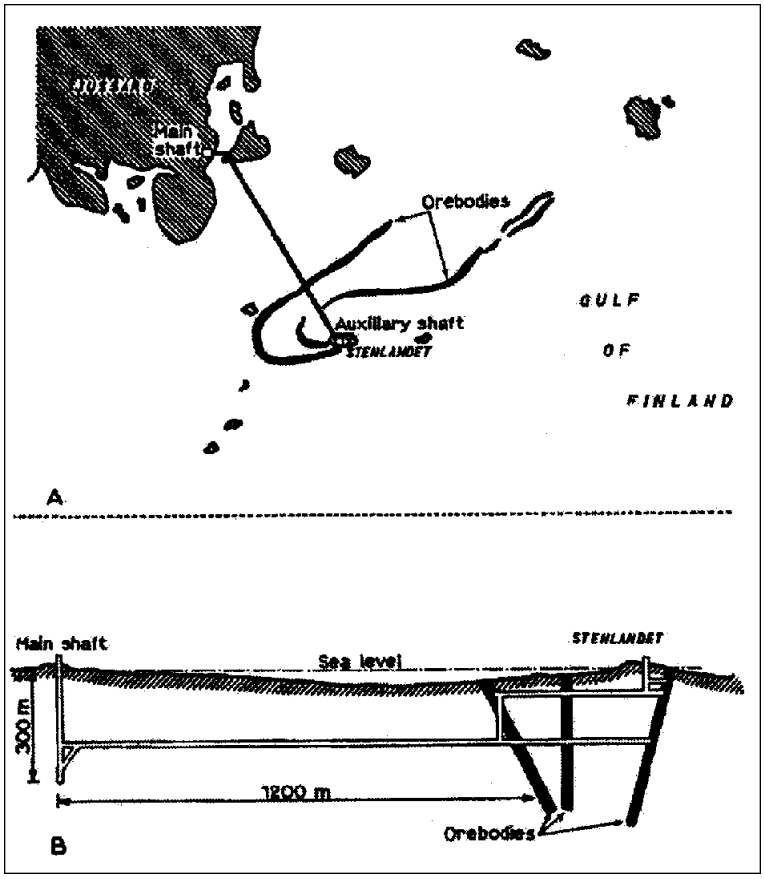

Illustration 1. Jussaro iron mine lies undersea off the coast of Finland. Notice there are two access shafts: one onshore, and the other offshore on a small island. The actual mine workings are undersea. The Jussaro mine is a good example of a deep mining operation beneath the sea floor. (Source: John L. Mero, *The Mineral Resources of the Sea*, Elsevier, New York, 1965)

The US Navy Paper Trail

One paper trail begins in 1966, with a letter on 18 April from Robert W. Van Dolah, of the US Bureau of Mines, to Dr William B. McLean, Technical Director for Research and Development at the US Naval Ordnance Test Station at China Lake, California.[5] In the letter, Mr Van Dolah alludes to Dr McLean's interest in "deep underwater exploration". Mr Van Dolah specifically refers to tunnelling at great depth under the ocean bottom. His letter says:

> In talking with some of our mining experts here, I find a consensus that sinking a shaft to 10,000 feet and driving a drift horizontally from this presents no severe problems (other than money perhaps) if the rock is competent and not faulted. One of the most difficult problems in deep mines is a sealing off of aquifers. It would seem that even if the rock were competent throughout the tunnel and drift, there might be rather difficult problems in breaking through to the bottom of the ocean and maintaining a seal against the high water pressure.

Mine Tunnels beneath the Sea

All over the world there are mines that extend offshore beneath the sea; in many cases, the mines were first excavated many decades ago, even one hundred years ago or more—as with the British coalmines that extend out under the North Sea and the Firth of Clyde.

Among the places where submarine coalmines have been worked, in addition to Britain, are Canada, New Zealand, Australia, Chile, Japan and Taiwan.[7] By way of further example of undersea hard-rock mining, there is the Jussaro Island undersea iron mine off the coast of Finland, beneath the Gulf of Finland. The Jussaro Island mine tunnels extend hundreds of feet beneath the sea to bodies of iron ore that lie just offshore. The tunnels are accessed from shafts that have been sunk from islands in the vicinity (see illustration 1).[8]

As alluded to above, in Britain coal has long been mined from under the North Sea and the Firth of Clyde, at depths ranging to as much as 1,800 feet below the sea floor.[9] In Cornwall, tin mines ran out under the Atlantic Ocean in the early years of the 20th century.[10] In Canada, there have been many undersea mines. Sixty-five years ago, coal was being mined three miles out to sea, off the coast of Nova Scotia, as far as 1,600 feet beneath the sea floor.[11] The Wabana iron mine[12] at Bell Island, Newfoundland, was mentioned above, but there has also been submarine mining in other places in Canada, including coalmining off Cape Breton Island, Nova Scotia[13] and elsewhere offshore from Nova Scotia,[14] as well as underwater off Vancouver Island, British Columbia.[15]

There have been other submarine coal mines off the coast of New South Wales, Australia,[16] and undersea in Japanese coastal waters, e.g., off the coast of Kyushu and elsewhere.[17] Coal has been mined off South America's Pacific coast, in Chile.[18] More submarine coal workings that extend out under the Bay of Biscay have been located at Arnao, Spain.[19] There were even submarine mine workings in the United States 80 years ago. The rich Treadwell Gold mines on Alaska's Douglas Island burrowed more than 2,000 feet deep under the Gastineau Channel in the early 20th century.[20]

Tunnelling out under oceans, seas, bays and estuaries has been done for a very, very long time, all over the world, stretching way back at least into the 19th century, if not before. Undersea tunnels can stretch for miles and reach depths of 2,000 feet or more beneath the ocean floor. Of course, today's technology is far more powerful and sophisticated than it was 50, 100 or 150 years ago. One can only speculate as to how long, how deep and how elaborate contemporary, clandestine, submarine tunnels might be.

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There are plenty of examples of submarine tunnelling in the civil engineering literature. Perhaps the most famous example is the Chunnel, the well-known high-speed rail link that burrows deep under the English Channel between France and England. It is so famous that it scarcely needs mentioning.

US Navy Underwater Construction Teams

Of course, if the US Navy has secretly constructed manned facilities and rail tunnels deep beneath the sea floor, it would need a cadre of trained personnel capable of heavy construction at great depth underwater. Is there evidence of a trained, underwater construction unit within the Navy? In fact, there is.

The Navy operates special Underwater Construction Teams (UCTs) out of Port Hueneme, California, and Little Creek, Virginia. The UCTs are special Seabee units that carry out underwater construction projects around the globe. These UCTs are deployed literally anywhere in the world "aboard ships and other seagoing platforms". Among the areas where UCTs have been deployed are Africa, the Arctic ice cap, Diego Garcia, Iceland, Bermuda, Australia and the Persian Gulf area. Each of the UCTs consists of three officers and 52 enlisted personnel. After a few years of experience in the UCTs, qualified divers are eligible to complete the Advanced Underwater Construction course at Port Hueneme, California. One of the requirements to be a UCT member is to be "eligible for a secret security clearance".[21]

In other words, there is a unit of specially trained personnel within the US Navy that carries out underwater construction projects all over the world and whose members have "secret" security clearances. This is exactly the type of unit that would be necessary for constructing secret, manned, undersea installations and/or tunnels many miles offshore—perhaps even in the middle of the ocean or beneath other bodies of water, large and small.

As an aside, during the Cold War between the United States and the Soviet Union, clandestine diving units operating from on board top-secret American submarines repeatedly conducted covert, communications cable tapping missions on the sea floor itself, in Russian coastal waters. The divers would never surface. The entire operations were carried out underwater, using submerged submarines as a base. The men would go out from the submarines and carry out their work on the sea floor, and then re-enter the submarines.[22]

If there are top-secret bases beneath the sea floor, the UCTs of the US Naval Facilities Engineering Command may possibly have helped build them, perhaps even on clandestine, submarine-based missions similar in secrecy and daring to the top-secret undersea communications cable tapping operations in recent decades.

Naval Facilities Engineering Service Center

If there are secret, undersea manned installations, then it is a safe bet that the US Navy's Naval Facilities Engineering Service Center (NFESC) constructs and maintains them, or knows who does. The NFESC's website says that it is "the Navy's center for specialized facilities engineering and technology".[23] The NFESC's website further advises that it constructs "Specialized Ocean Facilities". It states:

> We can help you with the design, construction, maintenance and repair of fixed ocean or underwater facilities from the shoreline to depths of 6,000 meters (20,000 feet). We can provide engineering services to meet your needs... We have an extensive inventory of specialized tools, equipment, vessels, and test facilities...

Notice that this agency is talking about the design, construction, maintenance and repair of underwater facilities as deep as 20,000 feet. Interestingly, the NFESC's Ocean Facilities Department includes both an Ocean Construction Division and a Seafloor Engineering Division.[25] This is exactly the sort of bureaucratic structure that one would expect to find if the US Navy has built secret, manned facilities beneath the seabed.

US Army Corps of Engineers

If secret, manned facilities under the seabed do exist, I would certainly expect to find evidence here and there that points to the possibility of such facilities—evidence of just the sort that I am presenting here.

During my research at the US Army Corps of Engineers

archives I discovered a Program Activity and Funding report, issued by the Corps of Engineers Construction Engineering Research Laboratory (CERL) as ENG FORM 0-4098 on 16 August 1967. It contains several entries that are germane to the instant discussion. Line Item 1, Task Number -01 states:[26]

Engineer Studies and Investigations
The objective of this task is to identify, analyze, and initiate research in areas of specialized military construction which are beyond the current state-of-the-art. This task will provide means for applying the current state-of-the-art and anticipated developments in the future. It will enable coordination of the construction research efforts of CERL and other DOD laboratories, government agencies, industry and educational institutions.

The report has several other interesting entries. Task Number -02-005 says:[27]

Sealing Deep Underground Structures
Explore economical epoxy coatings, concrete additives and other techniques for sealing walls from deep underground hydraulic pressure.

Of course, if the construction were taking place beneath the sea floor, the Army would want to seal the base against the unwelcome intrusion of the deep sea. The document contains more information that reveals the US Army's secret role underground. Task Number -05 says:[28]

Power Plant Construction
The objective of this task is to develop new essential knowledge in the design, operation and maintenance of fixed and floating power plants which is peculiar to military requirements. Essential knowledge is required in hardened above- and below-surface plants, in precise, uninterrupted power, and in system reliability and maintainability...

"Develop design criteria for hardened underground facilities to permit rapid concept selection and design of underground defense power systems."

The report then discusses Task Number -05-001:[29]

Hardened Underground Power Plants
Develop design criteria for hardened underground facilities to permit rapid concept selection and design of underground defense power systems.

And Task Number -05-004:[30]

Advanced Heat-Sink Technology
Develop design criteria for heat dissipation and storage in various underground geological formations as applicable to hardened underground facilities.

This information dovetails very nicely with other US Army information (presented earlier in my book) concerning the dissipation of excess heat that underground installations generate. This is a problem whether the subterranean facility is under a New Mexico desert, burrowed way down in the hard rock below the Antarctic ice sheet, deep beneath a sea mount in the mid-Atlantic Ridge or in the middle of the North American continent beneath the Midwestern cornfields. No matter where a deep underground base is located, it needs to get rid of excess heat.

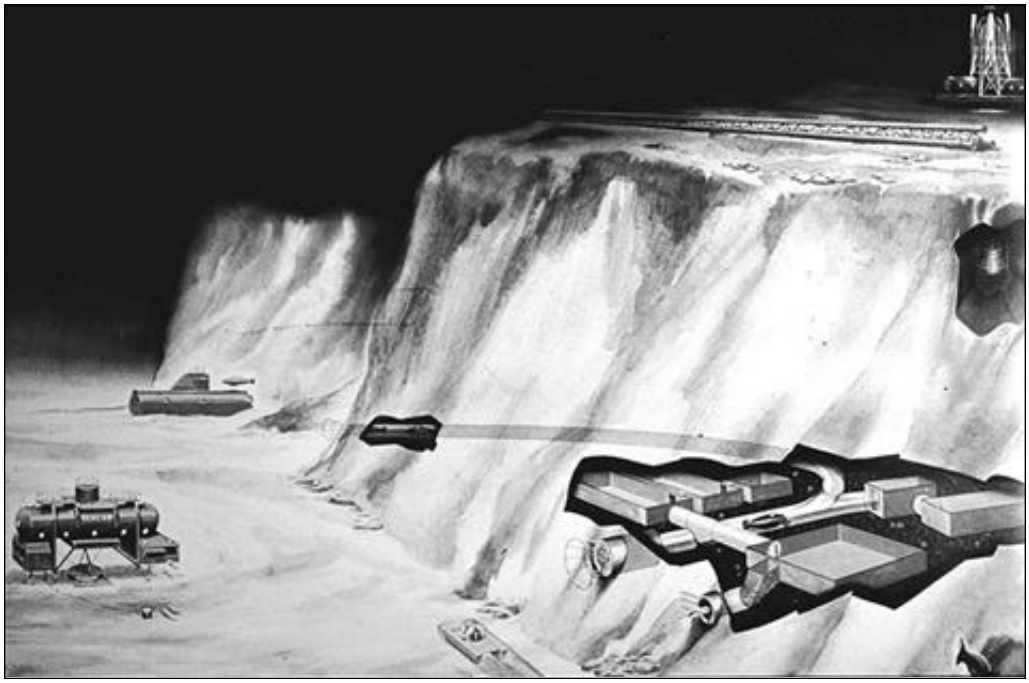

Illustration 2. Artist's depiction of Rock-Site Concept. Here you can see an undersea installation inside a sea mount, with locks for small submarines to come and go. A drilling derrick is on top of the mount, at upper right. The long tubular array on top of the mount could serve as a long-wave radio transmitter (ELF) or as a mechanism for water desalination and/or oxygen generation. (Source: US Navy)

Finally, the document gets around to talking about underwater construction. Task Number -07 says:[31]

Underwater Construction (CERC Work – CERL Management)
The objective of this task is to explore and develop ocean engineering technology to meet Army Military Construction objectives. This task, involving original exploratory developments, studies and inves-

tigations and utilization of knowledge and capabilities developed by other agencies involved in oceanography, is to provide methodology essential to planning for and construction of unique military facilities in marine environments.

This is an interesting choice of words: "construction of unique military facilities in marine environments". Lloyd A. Duscha, former Deputy Director of Engineering and Construction for the US Army Corps of Engineers in Washington, DC, said in a public speech:[32]

There are other projects of similar scope [to the NORAD base], which I cannot identify, but which included multiple chambers up to 50 feet wide and 100 feet high using the same excavation procedures [as] for the NORAD facility.

Mr Duscha then referred to the "critical and unusual nature of these projects". Might these large, secret, "critical and unusual" projects be the "unique military facilities in marine environments" that the US Army Corps of Engineers 1967 report refers to? Might both be referring to huge, deeply buried, undersea bases? I think that is very possible. The 1967 report continues with Task Number -07-001:[33]

Structural Systems for Underwater Construction
Develop concepts for constructing underwater storage and transportation facilities for ammunition and other hazardous materials.

Remember, this is the US Army talking about underwater construction, not the US Navy. We may have to rethink preconceived notions about which agencies do what. In the black-budget world of the Secret Team and the Invisible Government, the tidy agency boundaries that we are accustomed to thinking about may not be very relevant at all.

Finally, there is Task Number -07-002:[34]

Coastal Exploration
Develop techniques for rapid evaluation of coastal and inland bottom conditions for construction purposes.

Here the Army alludes to evaluation of the continental shelf (the ocean bottom just off the coastline) and inland bottom areas for underwater construction. Presumably those inland bottom areas would include (but not be limited to) areas such as Puget Sound in Washington state, Chesapeake Bay in the mid-Atlantic region, and the Great Lakes in the upper Midwest. It is my educated guess that any or all of these areas could be locations for clandestine, underwater facilities, deep beneath their bottoms. Is there any other evidence indicating the possible existence of secret, undersea bases, deep below the sea floor? In point of fact, there is.

The US Navy's Rock-Site Concept

A US Navy document from 1966 forthrightly discusses the construction of major military installations below the sea floor, in the middle of the ocean (illustration 2). Quoting from the title page:[35]

ABSTRACT. Large undersea installations with a shirt-sleeve environment have existed under the continental shelves for many decades. The technology now exists, using off-the-shelf petroleum, mining, submarine, and nuclear equipment, to establish permanent manned installations within the sea floor that do not have any air umbilical or other connection with the land or water surface, yet maintain a normal one-atmosphere environment within...

Large undersea installations with a shirt-sleeve environment have existed under the continental shelves for many decades.

(US Navy document, 1966)

The text of the report elaborates what is meant by the Rock-Site Concept:[36]

...a Rock-Site installation consists of a room or series of rooms, excavated within the bedrock beneath the sea floor, using the *in situ* bedrock as the construction material.

Note what is being said here. The installation is carved out of the native bedrock beneath the floor of the ocean itself. And the installation is composed of one or more "rooms". Now, keep in mind that a "room" to a hard-rock miner or underground construction engineer is not necessarily the same thing as a "room" in an ordinary house. At the beginning of the book I mentioned the dimensions of an underground power plant in the Himalayan Mountains of Bhutan that was hundreds of feet long and more than 100 feet high. Reflect on Lloyd Duscha's remarks, where he refers to multiple underground chambers more than 50 feet wide and 100 feet high. In fact, my research suggests that it would be within the state of the art in the underground construction industry to make mammoth underground chambers, in the middle of the ocean, hundreds of feet below the sea floor, that would have no visible connection to either the land or the surface of the ocean.

Because I realise this assertion may well be controversial for the uninitiated, I am going to quote at length from the US Navy's Rock-Site Concept report. As you read what follows, keep in mind that already in the 1960s the technology existed to construct facilities beneath the ocean floor that could accommodate full-sized submarines, with locks that would permit their crews to enter and exit, well below the surface of the sea. Over the last 35 years, the technology to carry out subterranean and submarine construction has only become more sophisticated and powerful.

Truth may indeed be stranger than fiction. I am increasingly inclined to think that such facilities just may have been built, and just may be in secret use. What follows is a little lengthy and a little technical, but is well worth the reading:[37]

Land-based undersea installations are not only practical today but are not overly expensive. The depth of shaft

needed for a land-based installation will depend on the depth needed to reach either a competent rock horizon beneath the sea floor or else a desired depth from a construction point of view. Assume an installation depth of 1,000 feet below the surface is desired. A probable depth of shaft is then 1,200 feet.

Shafts can be excavated by drilling and blasting, but a more usable shaft with far less maintenance and damage to the rock around the shaft will result from boring, a technique just now coming into general industrial use [mechanical shaft boring is now a common practice in the mining and underground construction industries; author's note].

With a bored shaft in the range of 5 to 8 feet in diameter, the cost will be roughly 4 million dollars completed [in 1966 dollars], including the life support and service systems, although some industrial firms will now estimate a cost of about 2 million dollars for this size of installation. Large diameter shaft drilling has been well discussed in the literature and extensive charts and graphs for detailed cost estimating are available.

For long distance undersea tunneling, boring is especially attractive. Boring methods require only electric power and yield no serious fumes or gases, as would be the case for tunnels driven by conventional explosive methods. Boring machines are now essentially off-the-shelf equipment for rocks ranging from rather weak shales to strong hard sandstones and have been used with encouraging results in even stronger metamorphic rocks.

With hydraulic or other automated handling of the ground-up waste rock, including ejection of the waste to the sea floor, tunnel boring in a rock strong enough to be fully self-supporting with a 15–20-foot-diameter bore can proceed at rates up to 5 miles per year for a cost of 1 to 1.5 million dollars per mile [in 1966 dollars]...

With modern-day shaft and tunnel boring techniques, access to the sea floor from land can be carried out at depths beneath the sea of several thousand feet (to at least 10,000 to 12,000 feet) and to distances offshore of tens to hundreds of miles.

Astonishing! Here is a US Navy document from the 1960s that plainly describes the capabilities of the underground construction industry at that time as fully able to tunnel out hundreds of miles beneath the ocean, at depths as great as two miles below the sea floor! I have spent a great deal of time in recent years reading tunnelling and underground excavation literature, and I assure you that the technology and the machinery for underground excavation has only become more powerful and more sophisticated in the intervening years. ∞

Editor's Note:

This article is extracted from chapters 5 and 6 of Dr Richard Sauder's book, ***Underwater and Underground Bases***, published by Adventures Unlimited Press, USA, 2001. It is available in Australia, New Zealand, UK and The Netherlands from NEXUS Magazine.

About the Author:

Richard Sauder, PhD, is a native Virginian who presently resides in San Antonio, Texas, USA. He has an abiding interest in Forteana and arcane sciences. He is the author of *Underground Bases and Tunnels* (1995; reviewed in NEXUS 2/26), *Kundalini Tales* (1998; reviewed in 6/02) and *Underwater and Underground Bases* (reviewed in 8/04). Dr Sauder welcomes solid information and documentation from readers on the topics he covers in his books as well as other esoteric or non-mainstream data.

Endnotes

1. The *Typhoons* are extremely large submarines. See Sherry Sontag and Christopher Drew, with Annette Lawrence Drew, *Blind Man's Bluff: The Untold Story of American Submarine Espionage*, Public Affairs, New York, 1998.

2. "For Missouri-born diver, Russian sub mission was like no other." Associated Press news article at http://www.cnn.com/2000/US/12/04/kursk.diver.ap/index.html.

3. For example, the Pacific Gas and Electric Company used a Robbins Company TBM to bore a 24'1"-diameter, 22,000-foot-long tunnel during construction of the Kerckhoff 2 Underground Hydroelectric Power Plant in the early 1980s. The power plant is about 30 miles northeast of Fresno, California. Typical rates of progress were anywhere from 60 to 100 feet per day. Assuming 365 days of work per year, the machine should average about 5.5 miles of tunnel annually. (See Edward R. Kennedy, P.E., "The Kerckhoff 2 Underground Hydroelectric Power Plant Project, A State-of-the-Art Application of a Tunnel Boring Machine", US National Committee on Tunneling Technology, *Tunneling Technology Newsletter*, number 38, June 1982.)

An 18-mile tunnel through fractured rock in Greece yielded extrapolated TBM net average advance rates of about 4.5 miles per year. (See G. Dolcini, S. Fuoco and R. Ribacchi, "Performance of TBMs in Complex Rock Masses", in *North American Tunneling '96, Vol. 1* [ed. Levent Ozdemir], A.A. Balkema, Rotterdam, Netherlands, and Brookfield, Vermont, USA, 1996, pp. 145-154.)

Another study projects rates up to 10 miles of tunnel per year or more "to be feasible within the possible level of attainment using today's machines in moderate conditions and without any further advance in machine technology". (See D. B. Parkes, *The Performance of Tunnel-Boring Machines in Rock*, CIRIA Special Publication 62, Construction Industry Research and Information Association, London, 1988.)

And the extrapolated annual rate of advance for the TBMs boring the Chunnel underneath the English Channel between France and England ranged from about 8 to 13 miles, assuming the machines' best monthly rates of progress. (See "Tunnel Boring Machines", Eurotunnel website, http://www.eurotunnel.com/eurouk/etplc/tbm.htm, 1999.)

The available evidence indicates that for contemporary tunnelling machines, an average rate of five miles per year is attainable even in fractured rock. In better conditions, tunnel boring machines can make advances of 10 miles or more per year. This is well within the state of the art in today's tunnelling industry.

4. "Japan proposes undersea tunnel to link S. Korea", http://www.indiatimes.com/221000toi/22worl15.htm, 2000.

5. Letter from Robert W. Van Dolah, Research Director, Explosives Research Center, United States Department of the Interior, Bureau of Mines, to Dr William B. McLean, Technical Director, Research and Development, US Naval Ordnance Test Station, China Lake, California, 18 April 1966.

6. The question as to the feasibility of deep shafts, i.e., large shafts that extend thousands of feet underground, has been definitively answered in the affirmative by the mining industry. I will cite just two examples from the many that can be found in the mining engineering literature; they suffice to prove the general point.

In the early 1980s, the Wyoming Mineral Corporation and Conoco, Inc. bored a 10-foot-diameter shaft to a depth of 2,243 feet in Crownpoint, New Mexico. They also bored a couple of other six-foot-diameter shafts to a depth of 2,188 feet at the same location, with the objective of developing a uranium mine at about 2,180 feet below the surface. (Hassell E. Hunter, "Drilled Shaft Construction at Crownpoint, New Mexico", in *Proceedings, 1983 Rapid Excavation and Tunneling Conference, Chicago, Illinois, 12–16 June 1983* [eds Harry Sutcliffe and John W. Wilson], The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc, New York, 1983, 1:544-565.

Twenty years earlier, a 9,673-foot shaft was sunk at the Western Deep Levels mine in South Africa. This shaft, which extends to virtually the 10,000-foot level mentioned by Van Dolah, has a lined diameter of 20 feet. ("World's Deepest Single Shaft", *The South African Mining and Engineering Journal*, 19 October 1962, p. 859) It is clear that shafts with diameters of 10 and 20 feet, that extend for thousands of feet underground, have been the state of the art in the mining industry for decades.

7. Shan-tung Lu, "Undersea Coal Mining", Paper presented to the Department of Mining, College of Mineral Industries, The Pennsylvania State University, University Park, Pennsylvania, USA, March 1959.

8. John L. Mero, *The Mineral Resources of the Sea*, Elsevier Publishing Company, New York, 1965.

9. George E. Sleight, "A Hydrographic Survey and Undersea Borings in Ayr Bay", *Transactions of The Institution of Mining Engineers*, vol. 112, 1952–1953, pp. 521-541; R. S. McLaren, "Undersea Mining off the North-East Durham Coast", *The Iron and Coal Trades Review*, 8 August 1952, pp. 301-309; J. H. Pierce, "Horden, One of England's Crack Collieries", *Coal Age*, vol. 34, no. 7, July 1929, pp. 406-409; J. T. Robertson, "Drifting Under the Firth of Forth", *Canadian Mining Journal*, December 1964, pp. 70-71.

10. "The Tin Mining Industry of Cornwall", *Scientific American*, Supplement, vol. LXIII, no. 1635, 4 May 1907, pp. 26189-26191.

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11. Sydney C. Mifflen, "Weak and Heavy Top Make Longwall and Mechanization Imperative in Nova Scotia", *Coal Age*, vol. 38, no. 7, July 1933, pp. 223-225; R. Dawson Hall, "Reallocation and Tunnels Make Nova Scotian Undersea Coal More Accessible from Shore", *Coal Age*, vol. 44, no. 10, October 1939, pp. 46-48; Alexander S. McNeil, "Notes on Mining Coal in Submarine Areas at Princess Colliery, Sydney Mines", *The Canadian Mining Journal*, 10 June 1921; and Louis Frost, "Submarine Mining in the Sydney Coalfield, Cape Breton Island, Eastern Canada", *Transactions of The Institution of Mining Engineers*, vol. LXXXI 1930–1931, pp. 406-425.
12. J. B. Gilliat, "Folding and Faulting of the Wabana Ore Deposits", *Monthly Bulletin of the Canadian Institute of Mining and Metallurgy*, no. 141, January 1924, pp. 895-913.
13. Richard H. Brown, "Submarine Coal Mining", *Mining Reporter*, vol. LIV, July to December 1906.
14. Francis W. Gray, "Mining Coal Under the Sea in Nova Scotia, With Notes on Comparable Undersea Coal-Mining Operations Elsewhere", *The Canadian Mining and Metallurgical Bulletin*, 1927, vol. XX, nos. 177-188, pp. 638-758; A.S. McNeil, "Nova Scotia Steel & Coal Co. Is Completely Removing Coal Seam Under Ten Square Miles of Sea Area", *Coal Age*, vol. 20, no. 6, 11 August 1921, pp. 205-209.
15. James Dickson, "Submarine Coal Mining at Nanaimo, Vancouver Island, British Columbia", *The Transactions of the Canadian Institute of Mining and Metallurgy and of the Mining Society of Nova Scotia 1935*, vol. XXXVIII, pp. 465-472; and "The Submarine Coal-Field of Nanaimo, Vancouver Island, BC", *The Canadian Mining Journal*, 25 March 1921.
16. A. Selwyn-Brown, "Submarine Coal Mining", *Engineering and Mining Journal*, 18 November 1905.
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21. US Naval Facilities Engineering Command, "Wanted: Seabees for Underwater Construction Teams". No publication date; possibly 1993. No place of publication given; possibly Alexandria, Virginia. Bibliographic information from Victor, University of Maryland online library catalog at http://www.lib.umd.edu/UMCP/, 1998.
22. Sherry Sontag and Christopher Drew, with Annette Lawrence Drew, *Blind Man's Bluff*, ibid. (see endnote 1).
23. At http://www.nfesc.navy.mil/, 1997.
24. At http://www.nfesc.navy.mil/ocean/, 1997.
25. At http://www.archrock.nfesc.navy.mil/ 7434dept.htm, 1997.
26. US Army Corps of Engineers, Construction Engineering Research Laboratory, Program Activity and Funding, ENG FORM 0-4098, 16 August 1967. I found this report in one of several boxes of documents that the archivist's assistant brought to me. The material was uncatalogued. She told me the documents were about to be thrown in the trash for lack of staff, funding and space to file them. There were several additional boxes of documents that I expressed an interest in seeing. However, as soon as I found the document cited here, the assistant refused to let me examine the documents in the additional boxes. She informed me that they were just full of worthless papers that were not worth my time. I assured her that, indeed, I would like to look at them. She adamantly refused to permit me to examine them.
27. ibid.
28. ibid.
29. ibid.
30. ibid.
31. ibid.
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